

WHAT IS CLAIMED IS:Sub.  
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1 1. A clay-polymer nanocomposite comprising an organoclay which has been  
 2 exfoliated into a polymer matrix, the organoclay being the reaction product of a  
 3 smectite clay with a quaternary ammonium compound which comprises a diester quat.

4 2. The nanocomposite of claim 1, wherein the organoclay is the reaction  
 5 product of a smectite clay with a diester quat in admixture with further quaternary  
 6 ammonium compounds having esterified radicals.

1 3. The nanocomposite of claim 1, wherein the diester quat is in admixture with  
 2 further quaternary ammonium compounds which are selected from one or more  
 3 members of the group consisting of triester and monoester quats.

1 4. The nanocomposite of claim 1, wherein the diester quat is present as  
 2 greater than 55 wt% of the quaternary mixture.

1 5. The nanocomposite of claim 4, wherein any triester quat comprises less  
 2 than 25 wt% of the quaternary mixture.

1 6. The nanocomposite of claim 5, wherein the fatty acids corresponding to  
 2 the esters in the quaternary mixture have a degree of unsaturation such that the iodine  
 3 value ("IV") is from about 20 to about 90.

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1 7. The nanocomposite of claim 6, wherein the diester quat content is greater  
 2 than 60 wt%, the triester quat content is less than 20 wt%, and the IV is from about 30  
 3 to about 70.

1 8. The nanocomposite of claim 7, wherein the diester quat content is greater  
 2 than 62%, the triester quat content is less than 17 wt%, and the IV is from about 40 to  
 3 about 60.

1 9. The nanocomposite of claim 8, wherein the IV is from about 45 to about  
 2 58.

1 10. An organoclay useful in preparing clay-polymer nanocomposites  
 2 comprising the reaction product of a smectite clay with a quaternary ammonium  
 3 compound which comprises a diester quat in admixture with further quaternary  
 4 ammonium compounds having esterified radicals.

1 11. The organoclay composition of claim 10, wherein the diester quat is in  
 2 admixture with further quaternary ammonium compounds which are selected from  
 3 one or more members of the group consisting of triester and monoester quats.

1 12. The organoclay composition of claim 11, wherein the diester quat is  
 2 present as greater than 55 wt% of the quaternary mixture.

1 13. The organoclay composition of claim 12, wherein a triester quat is present  
 2 and comprises less than 25 wt% of the quaternary mixture.

3 14. An organoclay composition in accordance with claim 13, wherein the  
 4 quaternary ammonium compound is the reaction product of C<sub>12</sub> - C<sub>22</sub> fatty acids or the

5 hydrogenation products thereof, or a mixture of such acids, with an alkanolamine in  
 6 the presence of an acid catalyst, wherein the ratio of fatty acid to alkanolamine is from  
 7 about 1.40 to 2.0.

1 15. The organoclay composition of claim 14, wherein the fatty acids  
 2 corresponding to the esters in the quaternary mixture have a degree of unsaturation  
 3 such that the iodine value ("IV") is from about 20 to about 90.

1 16. The organoclay composition of claim 15, wherein the diester quat content  
 2 is greater than 60 wt%, the triester quat content is less than 20 wt%, and the IV is  
 3 from about 30 to about 70.

1 17. The organoclay composition of claim 16, wherein the diester quat content  
 2 is greater than 62%, the triester quat content is less than 17 wt%, and the IV is from  
 3 about 40 to about 60.

1 ~~14~~ 18. The organoclay composition of claim ~~13~~, wherein the IV is from about 45  
 2 to about 58.

1 ~~15~~ 19. The organoclay composition of claim ~~8~~, wherein the smectite is selected  
 2 from the group consisting of hectorite, montmorillonite, bentonite, beidelite, saponite,  
 3 stevensite and mixtures thereof.

1 ~~16~~ 20. The organoclay composition of claim ~~15~~, wherein the smectite comprises  
 2 hectorite.

1 21. In the method for preparing a nanocomposite, by treating a smectite clay,  
 2 with an organic ammonium ion to intercalate the organic molecule between the

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cont.

3 silicate layers of the clay, thereby substantially swelling or expanding the interlayer  
4 spacing of the smectite; and exfoliating the expanded silicate layers in the presence of  
5 or with the assistance of a polymer with which reactive groups on the intercalated  
6 organic molecule are compatible, or in the presence of a monomer which is  
7 polymerized after being intermixed with the intercalated clay; the improvement which  
8 enables very high efficiency in the said exfoliation, comprising:  
9 utilizing as the source of the organic ammonium ion a quaternary ammonium  
10 compound which comprises a diester quat.

1 22. The method of claim 21, wherein the diester quat is in admixture with  
2 further quaternary ammonium compounds having esterified radicals.

1 23. The method of claim 22, wherein the diester quat is in admixture with  
2 further quaternary ammonium compounds which are selected from one or more  
3 members of the group consisting of triester and monoester quats.

1 24. The method of claim 23, wherein the diester quat is present as greater than  
2 55 wt% of the quaternary mixture.

1 25. The method of claim 23, wherein a triester quat is present and comprises  
2 less than 25 wt% of the quaternary mixture.

1 26. The method of claim 25, wherein the quaternary ammonium compound is  
2 the reaction product of  $C_{12}$  -  $C_{22}$  fatty acids or the hydrogenation products thereof, or a  
3 mixture of such acids, with an alkanolamine in the presence of an acid catalyst,  
4 wherein the ratio of fatty acid to alkanolamine is from about 1.40 to 2.0.

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5           27. The method of claim 26, wherein the fatty acids corresponding to the  
6   esters in the quaternary mixture have a degree of unsaturation such that the iodine  
7   value ("IV") is from about 20 to about 90.

1           28. The method of claim 27, wherein the diester quat content is greater than  
2   60 wt%, the triester quat content is less than 20 wt%, and the IV is from about 30 to  
3   about 70.

1           29. The method of claim 28, wherein the diester quat content is greater than  
2   62%, the triester quat content is less than 17 wt%, and the IV is from about 40 to  
3   about 60.

1           30. The method of claim 29, wherein the IV is from about 45 to about 58.

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